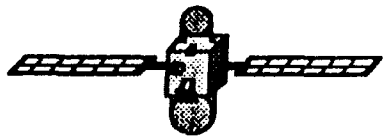


What is Digital DBS ?

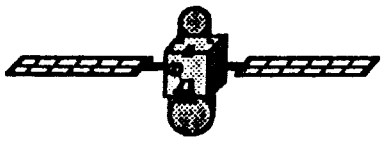
- **Digital DBS is both quantitatively and qualitatively different from analog satellite telecommunications services**

- **Digital DBS provides inexpensive fixed cost service to a mass market instead of a niche service constrained in volume by high start-up costs**

- **Digital DBS provides a huge increase in capacity over previous techniques More than a hundred educational channels will use only a small fraction of a DBS satellite's capability**

- **Higher capacity means a lower cost per delivered service, greater productivity**

- **Digital DBS can supply <u>new types</u> of service over its higher capacity**



How Has DBS Changed, 1982-1991 ?

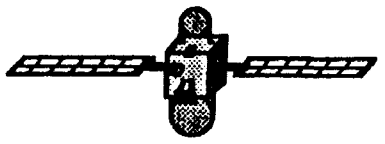
- Cost per delivered channel of full motion color video service has dropped by a factor of 20

- Enough programming available now, more will become available

- Demand for a broad array of video and other services is increasing

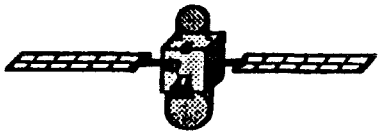
- Digital encoding significantly increases program security

- Cost of ground equipment in mass market "consumer electronic" range



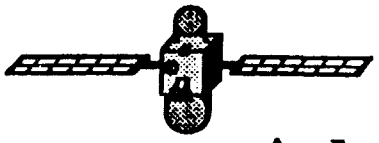
The Demand for DBS Services

- There are 94 million TV households in the US, growing at approximately one million per year
- 40 million of these have no cable services
- Surveys consistently report 9% of cable customers will switch to DBS in the first year of its availability; additional 25% likely to switch over 5 years
- Many rural areas will never have cable services
- Approximately 3 million C-band dishes in use
- DBS will provide basic services for less than average cable fees
- DBS will provide classes of services not available today



Digital DBS Facilitates New Services

- Transmission of computer software, quickly, accurately, and efficiently
- Transmission of CD quality music --ultra high fidelity audio
- Electronic publishing
- Flexible graphics and animation
- Interactive services
- Easy cooperative use with micro computers, etc.
- Best method to distribute HDTV signals



Advantages of DBS Over Cable

- Lower capital costs for digital delivery to all of the US
- Lower operating costs
- Greater capacity than existing analog cable systems
- Ability to deliver new types of services
- Greater program security than analog systems
- Diversifies source of multichannel programming delivery
- Universally available, often higher quality picture
- More efficient distribution of eventual HDTV signal

ACC Programming Services Strategy

- 28 to 42 channels will provide basic TV services
- 40 to 60 channels will provide PPV services
- several hundred educational channels through the YES Networks
- many channels for innovative services
- an additional 5 transponders may be authorized for ACC by the FCC

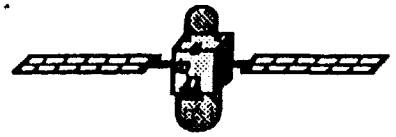
YES Networks

- **FCC frequency authority and orbital position already secured**

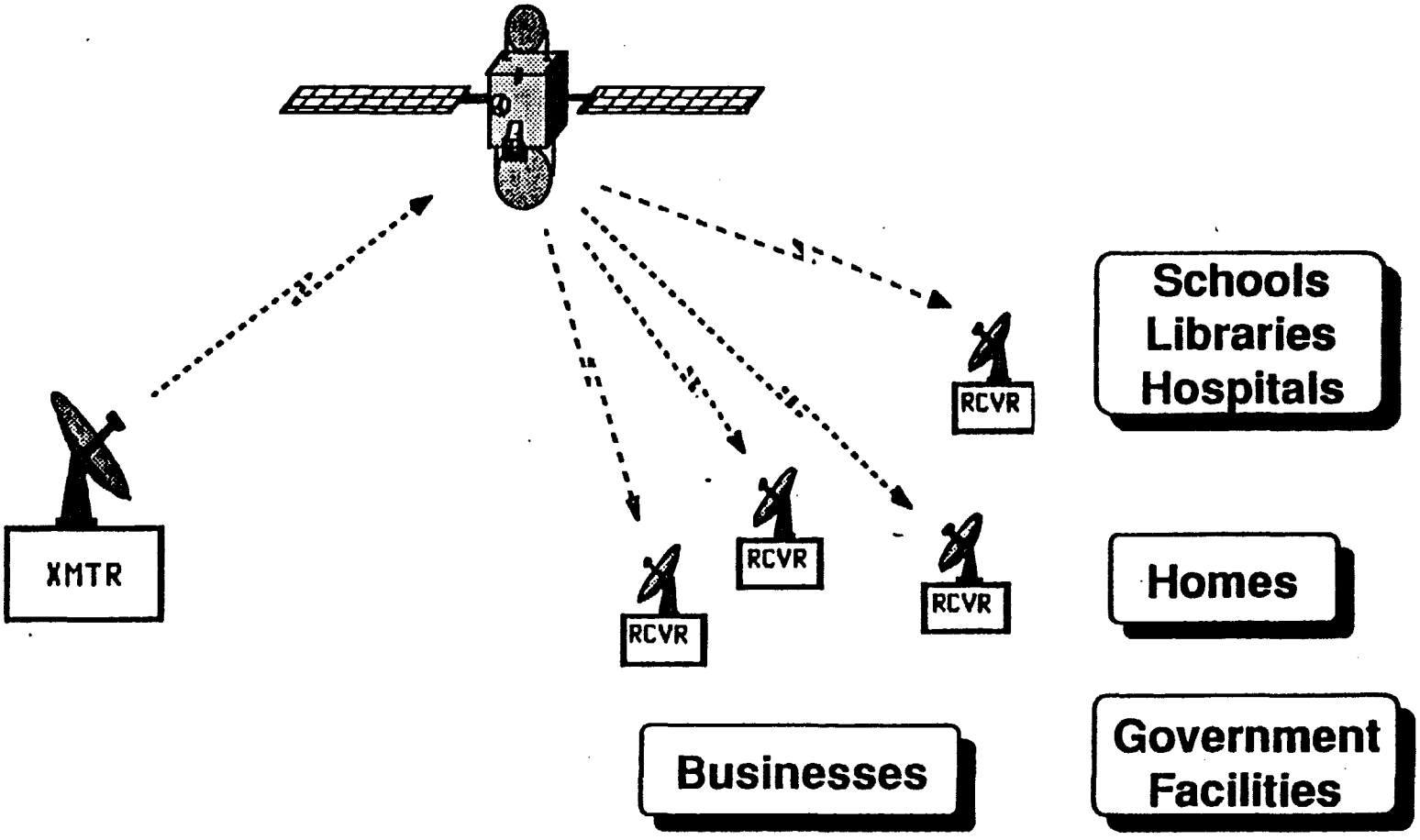
- **Satellites already under contract with General Electric**

- **FEAT has perpetual use of 4 transponders, each able to deliver more than 100 instructional channels**

- **FEAT has set a course and defined a blueprint for provision of DBS receivers to every school and library in the US-- <u>at no</u> cost**

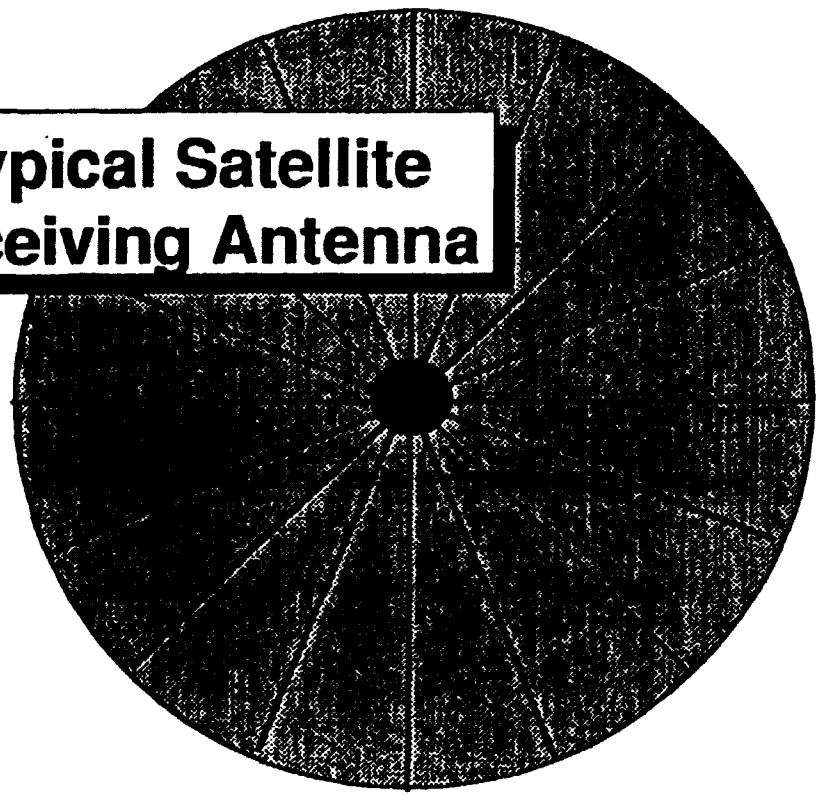


Universal Multichannel Distribution

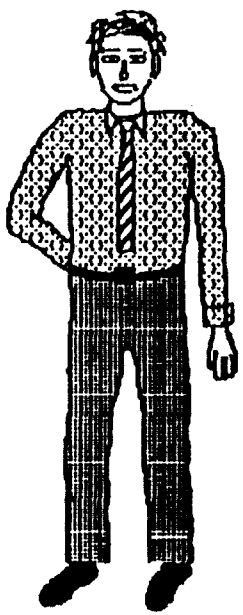


Antenna Size Comparison

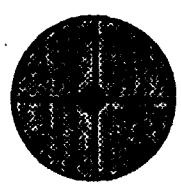
Typical Satellite Receiving Antenna



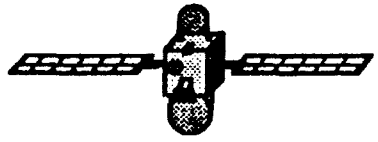
8' diameter. Requires pedestal, concrete pad, local zoning approval, and (sometimes) a fence.



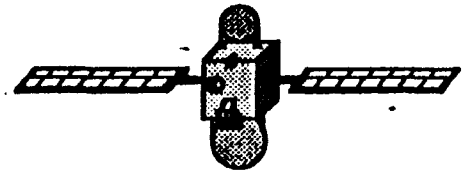
DBS Antenna

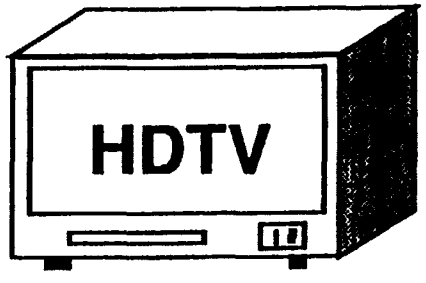


1.5' diameter. No pedestal or pad, local zoning preempted by FCC, installed by owner.



Converging Technologies: Expanded Services

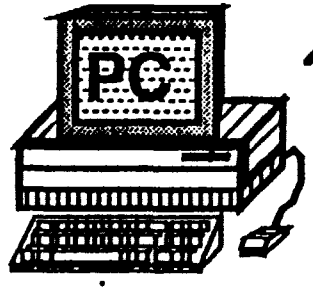




Converging Technologies

Digital DBS Broadcasting

Expanded Spectrum of Services

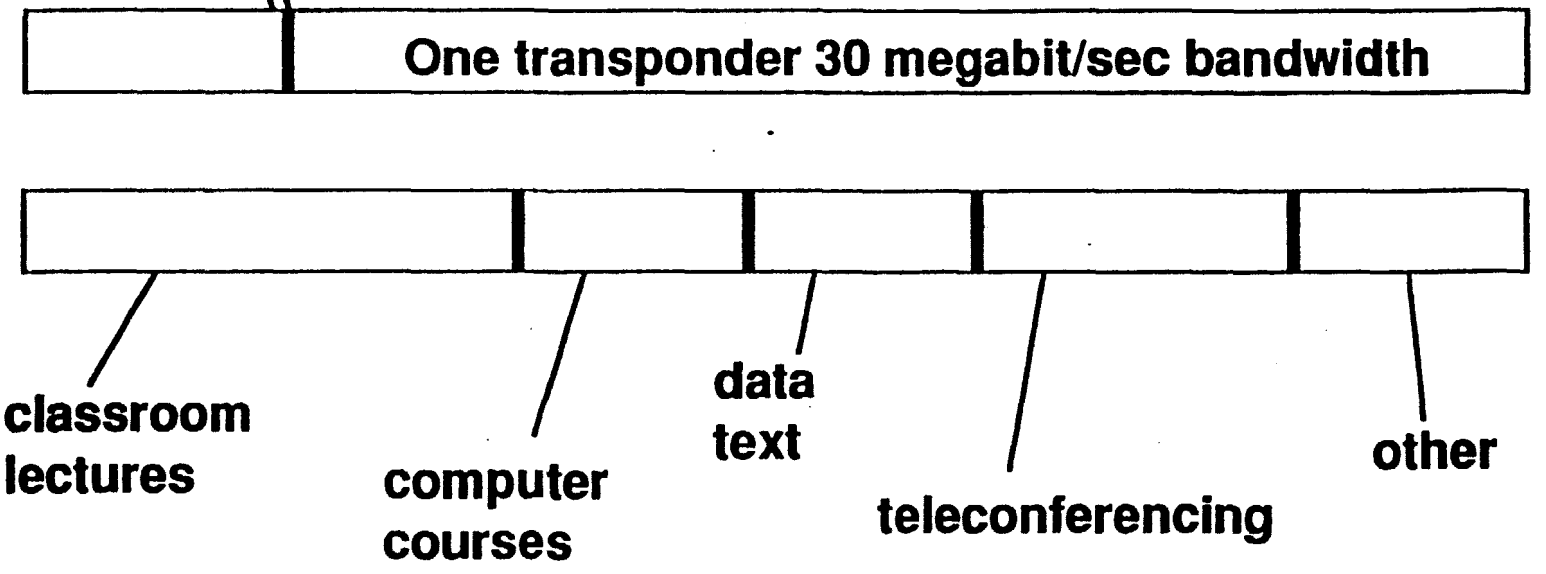


New low-cost services (e.g., Education)

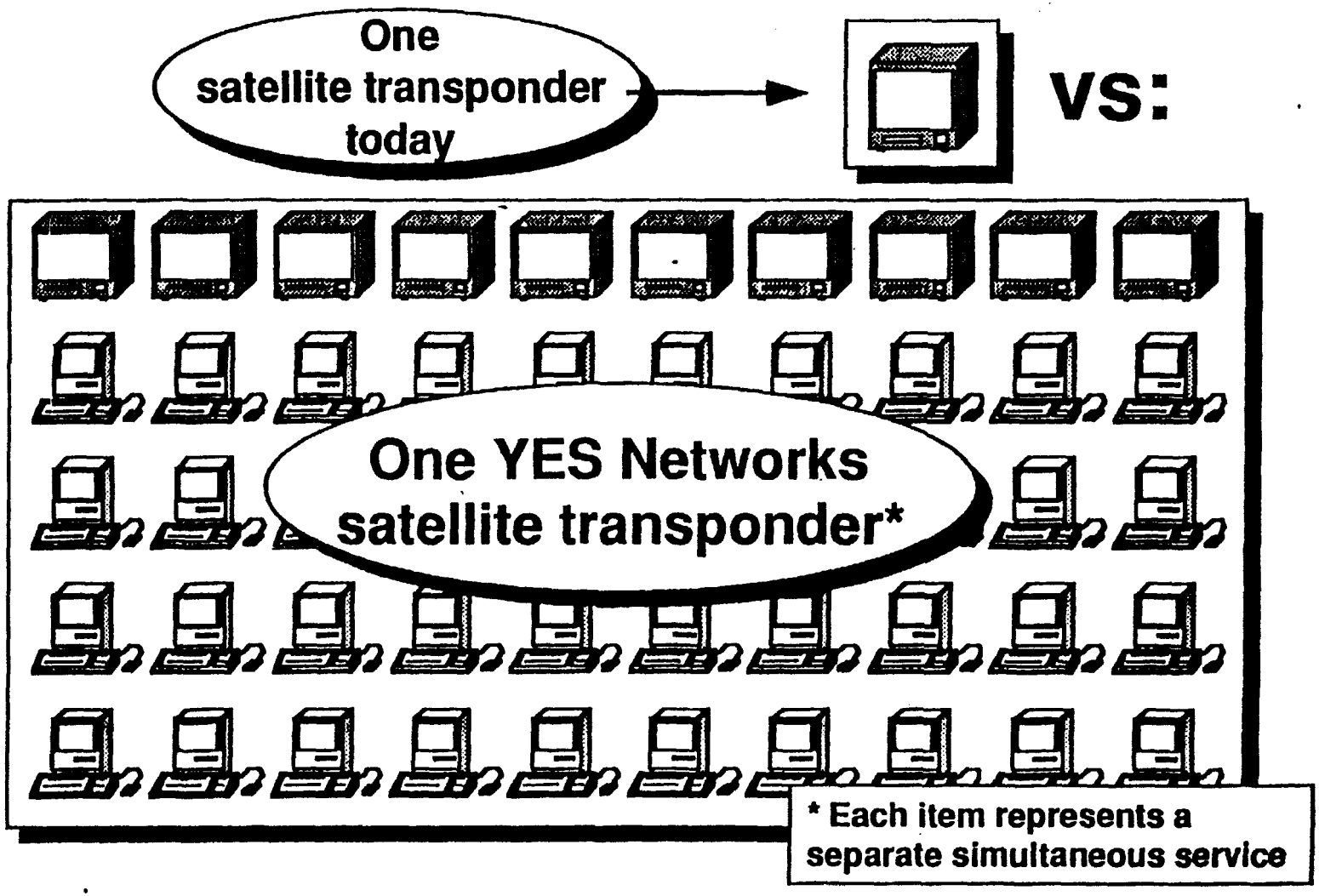
Capacity of One FEAT Transponder

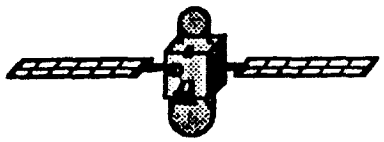
- 30 megabits per second
- One classroom lecture uses 250 kilobits per second

120 such lectures are possible on one transponder

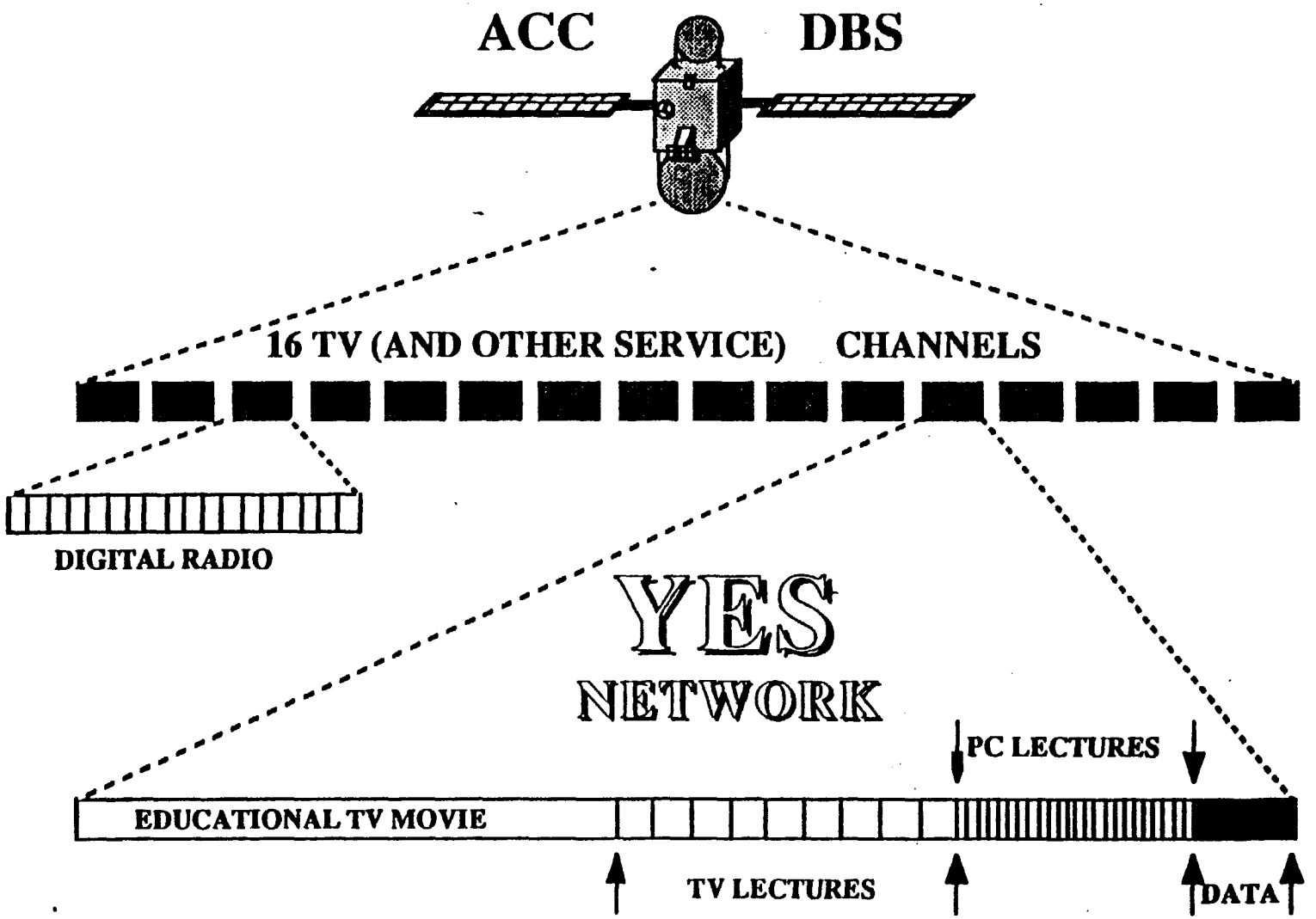


Service Comparison





Satellite Channelization



Who will use YES Networks ?

- All interested elementary and secondary schools, both public and private
- All interested libraries, both public and private
- All interested universities, especially teacher training, both public and private
- National Educational Associations
- Vocational and technical schools
- Adult and professional continuing education programs (teaching, legal, engineering, accounting, medical, business)
- Local, State, and Federal Government Education Administrators

Who will use YES Networks ? (continued)

- Prison rehabilitation/education programs
- Drug treatment and rehabilitation programs
- Emergency Broadcast System (assistance in natural disasters)
- Medical data interchange (especially imagery)
- Training for child care center staff and administrators
- Senior citizen programs including Social Security information
- In home training and advice for parents

Who supplies educational programming?

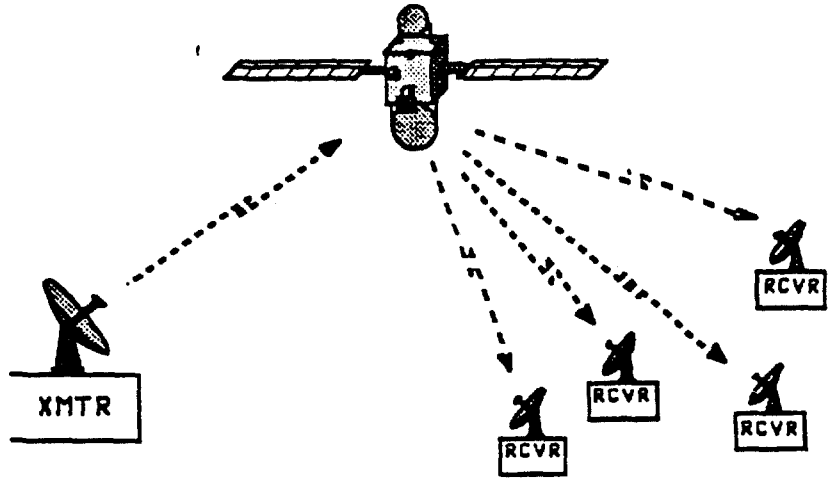
- Current and future educational programming suppliers
- Universities and school districts
- Educational associations
- Vocational-technical schools
- State and Federal educational organizations
- Textbook and other Publishing companies
- Educational or distance learning cottage industry
- YES Networks

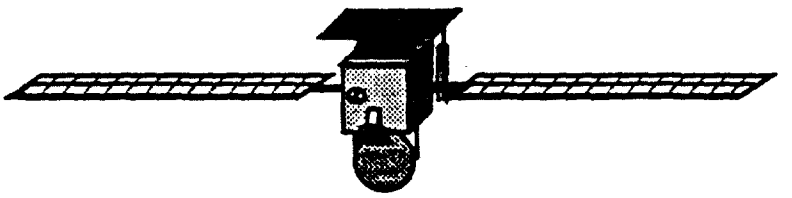
Commonly Asked Questions About ACE's Digital DBS Distance Learning System

January 8, 1991

Advanced Communications Engineering, Inc.

G. Gordon Apple, PhD





Abstract

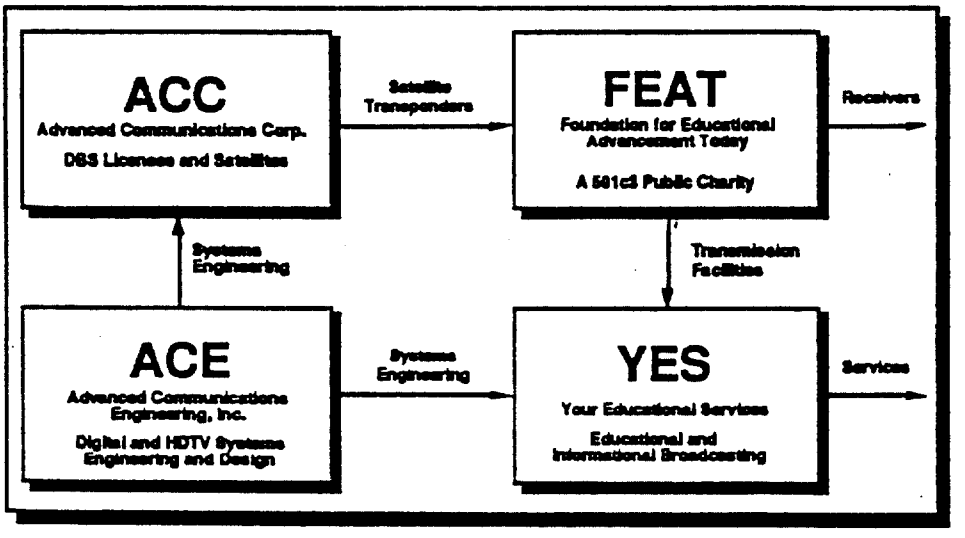
ACE (Advanced Communications Engineering, Inc.) is developing a radically new type of broadcasting system which will provide the backbone of basic services and form the basis for a myriad of new services on ACC's (Advanced Communications Corporation) high-power Digital Direct Broadcast Satellites (DBS). Among these new services will be the YES (Your Educational Services) Networks, initially underwritten by the Foundation for Educational Advancement Today (FEAT).

Many papers (with limited distribution) have been written about this system during the past six years. Rather than repeating the system conceptual description, which formed the basis of most of these papers, an informal Q&A format has been chosen here to address specific topics and concerns which appear to be of the most interest to those involved in the Educational Professions.

Contents

Introduction

Digital video compression, digital radio, personal computers, continually decreasing costs of digital electronics, immanent HDTV, universal signal access, and many other factors **now make Digital DBS the obvious choice** for an integrated-service nationwide broadcasting system. The advantages offered by ACE's system on ACC's DBS satellites will allow FEAT to offer a large number of educational services through the YES Networks.



Now that we have waded through the relevant alphabet soup of organizations, the following major categories of questions are treated:

- What exactly is ACE's new system?
- How is it different from what exists now?
- What impact will it have on education?
- How will students and teachers use it?
- What about cost?
- What about teacher training?
- How will teachers and students respond to this technology?

Q & A

Why do we need distance learning?

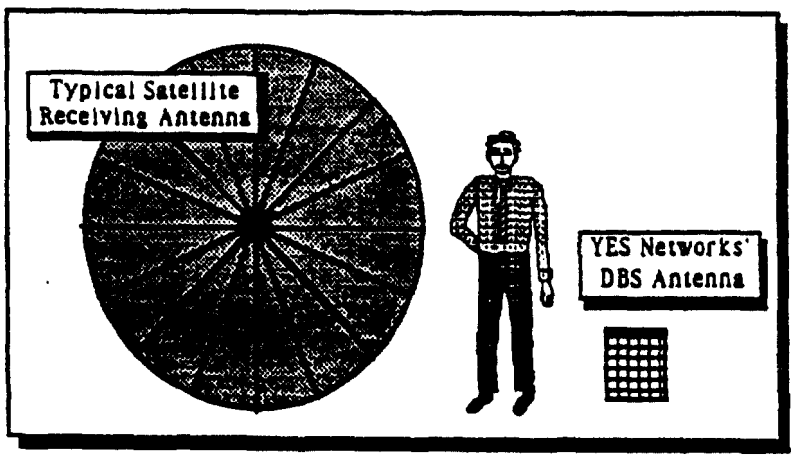
How about two hours of stop and go traffic and exhaust fumes on L.A.'s San Diego Freeway for a 50 minute lecture? How about three or four hours of bus rides for a rural student who cannot otherwise take an essential class? Distance learning brings the mountain to Muhammad. There as many reasons for distance learning as there are individuals. Even when many educational services are available locally, distance learning can greatly expand the choices.

Why satellites?

Satellite signals can reach almost anywhere in the nation (or world) and do not depend on installation of terrestrial distribution plant or physical proximity to source or facilities. Almost all states now have some type of satellite distance learning program. The Star Schools program has helped to initialize many of these programs.

Why DBS satellite?

Today's satellite receiving terminals require dish antennas that are 8, 10, or 12 feet in diameter and typically require a substantial mounting pedestal and a fenced enclosure. Many residential areas prohibit such large and unsightly antennas. High powered wide-spaced DBS satellites, on the other hand, require only a light weight 1.5 - 2 ft. antenna that can be easily mounted outdoors or indoors and can be pointed through a window or sky light. Residential prohibition has been pre-empted by the FCC for antennas of this small size. The receiver will be an inexpensive mass produced unit which will also be used for home entertainment television reception.

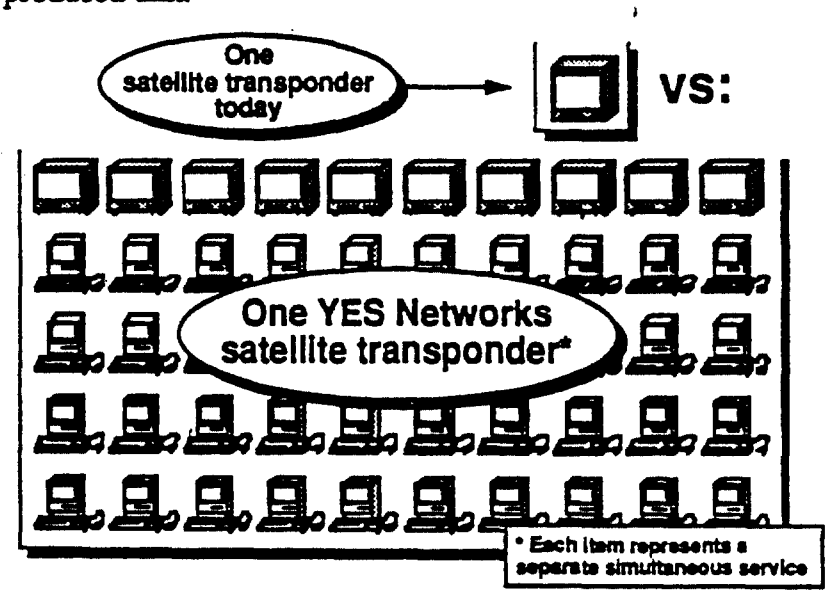


Why Digital DBS satellites?

The digital processing necessary for digital transmission is now economically feasible and makes possible a substantial increase in capability and flexibility. Therefore, even though a DBS satellite itself is initially more expensive than a low-powered satellite, individual program (or course) transmission costs can be much less. This is in addition to the advantage of inexpensive receivers.

Why ACE's Digital DBS system?

ACE is developing a fundamentally new type of broadcasting system to be implemented on DBS satellites. It is a universal, totally flexible system which can dynamically reconfigure and adapt to the constantly changing needs of broadcasters and other service providers. It includes a broad framework for many types of video and audio compression techniques, and uses receiver terminals which inherently include processing power equivalent to a powerful personal computer, all in an inexpensive mass-produced unit.



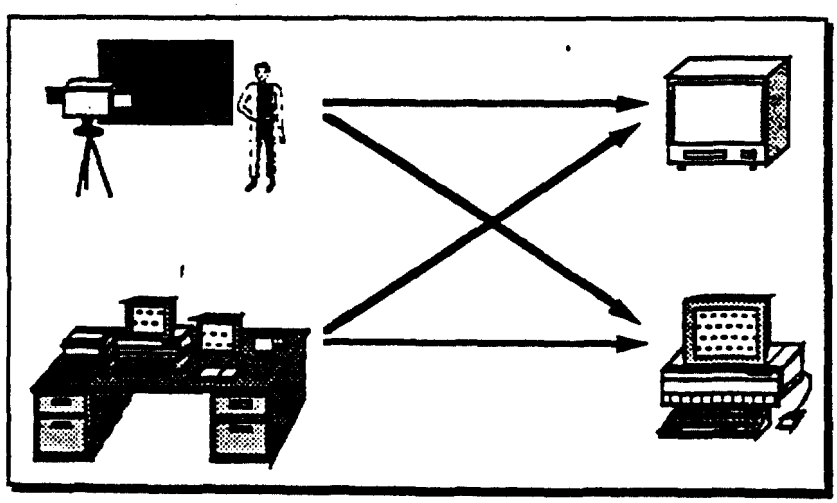
Who are YES and FEAT?

Recognizing the immense breakthrough potential of ACE's radically new system for use in distance learning, Mr. Dan Garner (president and principle of ACC) and former House Ways and Means Committee Chairman, the Honorable Wilbur D. Mills, were instrumental in establishing the Foundation for Educational Advancement Today (FEAT), a 501c3 public charity. Mr. Garner has agreed to donate up to four transponders for use by FEAT for educational broadcasting. In addition, FEAT will be the focal point to raise the funds necessary to operate a nationwide educational

broadcasting system, known as Your Educational Services Networks (YES). ACE's system will allow YES to offer up to a few hundred courses simultaneously, far in excess of the total number of distance learning courses offered by other means today.

But what exactly is it?

The ACE Digital DBS System allows a large number of diverse services to be efficiently combined through the satellite(s). It can include traditional television course broadcasts, computer graphics, direct broadcast to personal computers, computer file transfers, CD-quality sound, downloaded interactive lessons, or anything else that the originator might decide to include. The system is an open pipe to use as one sees fit. The receiver can connect to a standard TV set, a non-interlaced monitor, a projector, a personal computer, or any other appropriate device. Once the receiver converts the signal to video, the video portion of a program (course, seminar, etc.) can be recorded on an ordinary VCR if desired. If computer storage means are provided, other program information and material can also be retained when offered.



This will be complicated to use, right?

Wrong. ACE is including very sophisticated software and computer control through the satellite to the receivers, in order to make the graphical user interface very simple and intuitive. It will be a lot easier than your VCR, (which still probably has the clock flashing). Of course, if you insist and

persist, you can get into this thing hip-deep. However, we are deliberately not going to make that too easy unless you really know what you are doing.

Can I use the receiver with other media?

The answer is a definite "probably." A basic design premise is that of open architecture where other interfaces can be included, such as for interactive laser discs, CD ROM, CDI, etc.

How about interactivity?

The combined TV/ Computer nature of ACE's receivers enables supplementary and computer interactive materials to be downloaded for use during or after a lecture. This will provide alternate means of handling commonly asked questions or provide for remedial or advanced study. Telephone lines can be used as they presently are, for student/ instructor interaction. The receiver will include a telephone line modem (at least 2400 bps) that can be used for computer networking or voice mail. Other means are also being considered.

What about hypertext and hypermedia?

Hypertext and hypermedia are a means of breaking the bonds of linear, ridged, static information such as that presented in traditional textbooks. In electronic hypermedia form, information can be made available to an arbitrary depth, be presented relationally, be shown dynamically, be experimented with, and be explored interactively. A certain amount of this can be included directly into the course broadcast to be used by the students during the class under general direction of the instructor. For off-line or more in-depth study, some type of storage media will be required such as floppy disks, optical disks (which should become as inexpensive as floppy disks), or other. The study materials can be downloaded concurrent with the lecture. At a later time, feedback on material usage and effectiveness could be modemed to the instructor (automatically). In this manner, the instructor can focus the students' attention on the desired subject areas while still allowing the students a wide latitude for exploration and self pacing.

Will teachers have to become computer experts?

Does owning a new car mean you have to become a mechanical expert? Or do you just want to drive it? One of the myths in education today is that teachers and students must become "computer literate" (i.e., "computer experts", ok, "computer conversant"). The ACE receiver, even though it has a microprocessor, is simply a tool to help students learn both classical and modern lessons. On one level it is simply another type of TV set. On another level, it is a personal computer which can do whatever you desire. One of the big advantages of this system is that, even for interactive media, any necessary instructions can be given and demonstrated as part of the broadcast. A local instructor

(if available) can concentrate on helping students who need special attention. This system is designed to alleviate the fears of the most severe technophobes.

This is really a plot to eliminate teachers, right?

Are disposable diapers a plot to eliminate mothers? The house is burning down now and we're discussing which fire hose to use! This system is intended to **help** teachers—Help reach students that can't travel—Help with the mundane tasks so teachers can help and guide individuals who really need it—Ease the work burden—Improve overall quality of education—Improve teacher skills—Allow the teacher to manage the learning process rather than trying to force-feed those who are satiated on TV, Nintendo, and other such things.

Will this mean loss of local control to a remote entity?

Not really. There will be a smorgasbord of alternatives from which to choose. If you don't like the choices, it's likely that others also don't. So join forces and start your own. The huge program capacity of this system means that it is not terribly expensive and allows accessibility. It is certainly possible that it will mean increased (voluntary) standardization, such as following the NCTM "Math Framework." However, the choice of whether or not to use it is always there.

What is "video compression"?

Video compression is simply being more intelligent about how images are represented. We don't need to send much information if the image is a black cat in a coal bin or a polar bear in a snow storm. Normal images contain considerable redundancy which can be removed by mathematical and statistical techniques. The inverse process restores the image to some facsimile of the original. If we send enough information and are intelligent enough about using it, the image can accurately be restored. There are many techniques available, some that are becoming standard, some proprietary. The alphabet soup gets a little thick here with standards, techniques, and formats such as ADPCM, various kinds of transforms, vector quantization, Huffman Codes, interframe coding, motion compensation, MPEG, JPEG, CCITT x64, DVI, CDI, and a plethora of others. Video conferencing equipment often uses some of these techniques. However, if you have seen video conferences operating at low transmission rates, forget it. The ACE approach combines standard and proprietary techniques of image coding along with statistical multiplexing to offer very-high-quality video. Don't sweat it. It works.

Is compression the sole reason for the huge course capacity?

No, definitely not. ACE's proprietary transmission framework allows information (including video) to be very effectively transmitted in a wide variety of formats. Remember that the receiver is